# 125

# WAYS TO BETTER POWER SHOVEL-CRANE OPERATION

PCSA
POWER CRANE AND SHOVEL ASSOCIATION

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This booklet has been published by the Power Crane & Shovel Association in the interests of better, safer, more profitable operation of Power Shovels, Cranes, Draglines, Clamshells and Hoes.

POWER CRANE AND SHOVEL ASSOCIATION
A BUREAU OF
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# 125 ways to better Power Shovel - Crane Operation

THE OPERATOR'S THE BRAINS

## THE OPERATOR IS THE "BRAIN"

—"It's almost human" — how many times have you heard this remark made about a power shovel by the crowd of "Sidewalk Superintendents" who have gathered to watch a shovel at work deep in an excavation?

Of course, the shovel itself isn't human; it's a cold, inanimate assembly of gears and shafts that becomes "alive" only when it is equipped with a "brain" capable of bringing out its capabilities.

It's the man at the levers — the operator — who really furnishes the "brains" to make the shovel "human" and who is, therefore, the most important contributor to the whole success of the excavator . . . Our hats are off to the really good operators because on any shovel-crane job they are really the "Bosses".

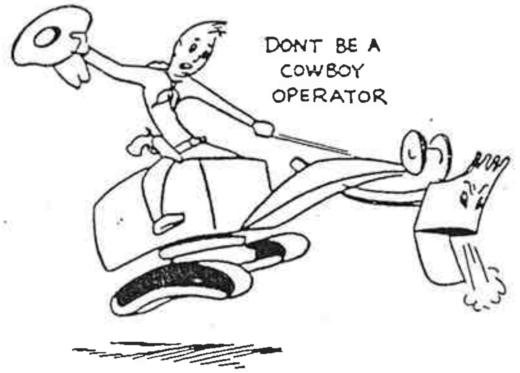
**When It Comes to "Brains" it Pays to Hire the Best**—The owner of a power crane or shovel has a big investment tied up in it—and this investment is worth no more to him than the ability, experience and, most importantly, the interest of the operator . . .

Therefore, the owner wants to employ the best he can get in intelligence, reliability and thoroughness. Sobriety, willingness to follow instructions and lack of tendencies toward recklessness are characteristics that will protect his valuable investment and produce a profitable return on it.

**Read the Instruction Manuals**—Every manufacturer spends a lot of money on expertly prepared Instruction Manuals for operators.

Regardless of how excellent these may be, they don't mean a thing if they aren't read and used . . . or if they can't be found when needed.

The time to read an Instruction Manual is before you start pushing the levers, not after something goes haywire . . . Keep the Instruction Manuals on the machine, where they'll be handy to all interested parties.



**Steady Production Counts** — Develop a smooth well-balanced working cycle, with maximum safe overlap of motions . . . Jerky, cowboy operation may be "flashy" and look fast but it's hard on the machine and, in the long run, doesn't produce the biggest yardage.

Watch *monthly* output rather than *daily* records. Set a comfortable pace you can maintain; then keep it up on every shift. The amount of dirt you move is what counts with the boss—not how good a "show" you put on!

**Keep Busy**—Keep busy while waiting; make any necessary adjustments — move up — loosen the bank—clean up the corners—level the grade. The minutes you lose waiting represent yards that don't get into the wagon.

**Don't be a "Lever-fighter"**—Be at ease and don't fight the levers. If anything goes wrong, don't start to fight the machine and force it beyond *its* ability or *your* control of it . . . To do so is a good way to tear up transmission, gears, clutches, brakes . . . Remember, *bad temper* means *bad performance.*

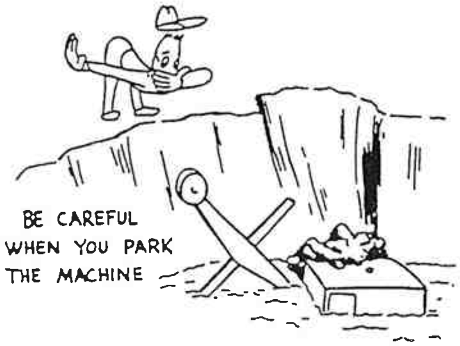
**Have a Plan**– Establish a definite procedure for inspection, adjustment and maintenance of your machine. As the operator, you're usually responsible for the mechanical condition of your machine and for reporting unsafe conditions. Here are some items that indicate good planning:

(a) Keep the machine in good operating condition, especially Clutches, Brakes and Controls.

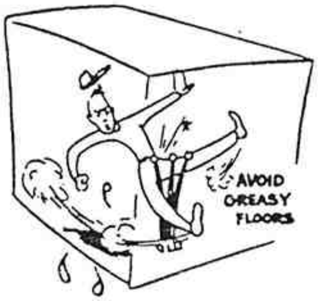
(b) Adjust Band Clutches when they are at operating temperatures. Be sure Clutches have proper clearances with Friction Drums when released. Otherwise dragging may occur which will cause excessive wear and hard operation.

(c) Use the proper lubricants, as recommended by the manufacturers, and *USE THEM* in the amounts and on the schedule recommended. Correct lubrication means longer machine life.

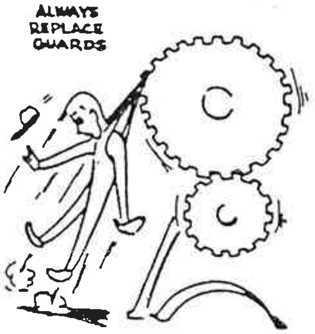
(d) Shut off the power, disengage engine Clutch, and lock all controls before leaving the Cab.



(e) Don't park your machine overnight, or for the week-end, when there is a chance of a bank caving in on it. Don't leave it in a low-spot where heavy rains or floods are apt to wash out the footing.



(f) Be a good housekeeper. Keeping a machine in good repairs is not enough. Keep dirt and grit out of moving parts by keeping a clean machine—free of excess oil, grease, mud, and rubbish, thus reducing accident and fire hazards.



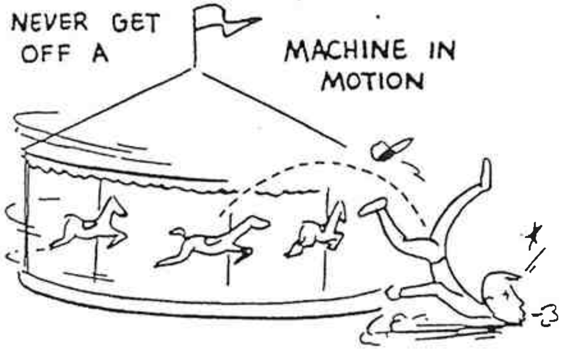
(g) Replace all guards and panels that are meant to protect *you* from moving machinery.

## STARTING AND STOPPING THE MACHINE

WARM-UP....
BEFORE YOU START TO PITCH!

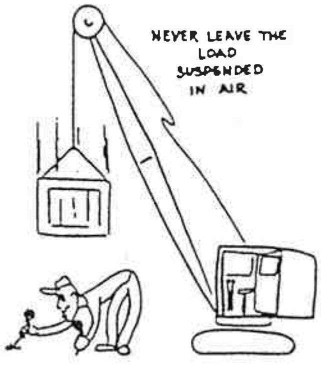
**Warm up Before You Start to Pitch**—Warm up a cold engine by letting it idle slowly. Don't use the choke more than is absolutely necessary.

**Shift Jaw Clutches at Slow Speed** — When shifting Jaw Clutches, be sure the Jaw Clutch Shafts are stationary or running at very slow speeds before engaging or disengaging Jaw Clutches.



**Never get on or off a Machine in Motion**—If you do, old man "centrifugal force" may throw you for a nasty, injurious spill.

**Stop the Machine for Lubrication or Adjustment**—Stop all operations when cleaning, adjusting or lubricating the machine . . . Usually this can be done by disengaging the Power-Take-Off Clutch but if it's going to be a long delay, shut off the engine completely.


NEVER LEAVE THE LOAD SUSPENDED IN AIR

**Don't Leave Loads in the Air**—Never leave the machine with the load or Dipper suspended in the air. The Brakes might cool off or slip and drop the load . . . Always set the Dipper or load on the ground whenever you leave the machine.

**Don't Shut Off the Engine Abruptly**—Before shutting down a heavily worked engine, let it run without any load at part throttle for a little while to cool off.

**Never Jump Off a Machine Under Normal Circumstances**—even if it's standing still. If your foot strikes a hole, loose pebbles, an icy spot, you're in trouble . . . Use the hand-holds and steps provided for your safety.

## TAKE CARE OF THE PITMEN

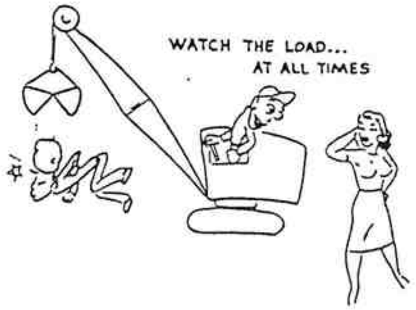
**See That They Watch Themselves** — Men should be kept out of the pit as much as possible. Have them watch out for caving banks and rolling stones — and be ready to run. The shift in bank stresses before a cave-in usually is indicated by a trickle of loose material.

NEVER SWING OVER GROUND MEN

**Never Swing Over the Ground Crew.**

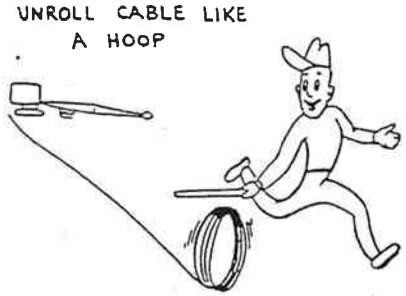
**Be Sure Everyone is in the Clear Before Backing Up.**

**Never Swing Over a Truck Until the Driver has left the Cab.**


WATCH THE LOAD... AT ALL TIMES

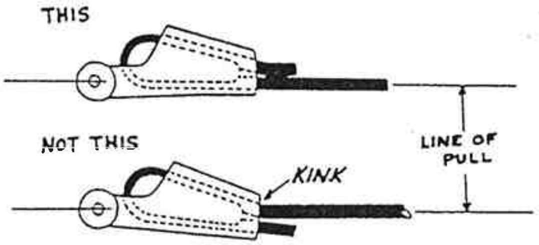
**Watch the Load at All Times** —Watch the dipper, bucket or load, while it is moving. In case you must look in another direction, stop the machine at once. Remember, a moving load can be a weapon of destruction when out of control. Watch it.

## CABLE HINTS

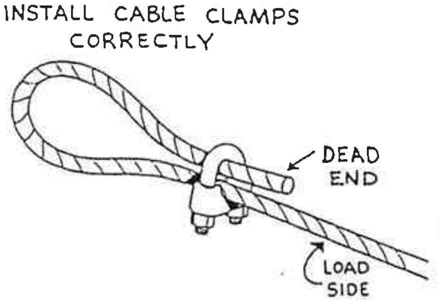

UNROLL CABLE LIKE A HOOP

**Don't Kink a Cable**—Do not kink a cable or it may be ruined. If it is to be uncoiled from a reel, mount the reel on a horizontal shaft, and spool it off the rotating reel. If it is in a coil, uncoil it by rolling the coil along the ground like a hoop. Any other method will just get you a lot of twists and kinks. Don't stretch cables where they may be driven over by trucks, tractors or other heavy equipment.

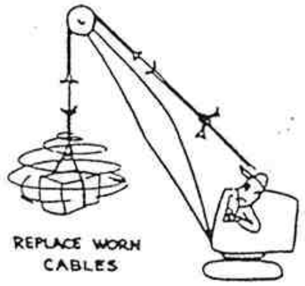
**Go Easy with a New Cable**— After a new Cable is installed, operate first with a light load to let the Cable adjust itself.



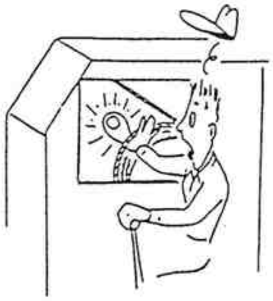
**Install Cable Sockets Correctly**—When installing cable sockets, the load line should be in a straight line pull with the eye of the socket. If the cable is put in backwards, a kink will develop at the point where it enters the socket . . . and rapid wear will result.



**Install Cable Clips Correctly**—When installing Cable Clips, be sure to put the U-bolt side on the loose side and not on the load side of the Cable. If put on backwards, the Clip will only develop approximately 40% to 50% of the Cable strength.



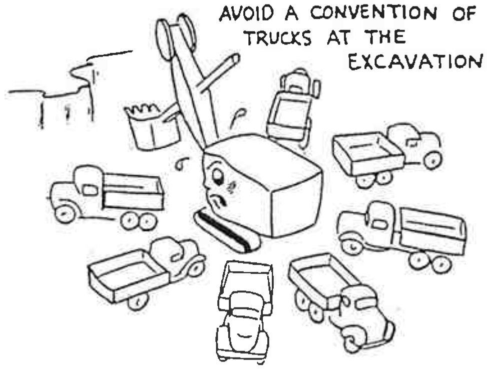
Look for Broken Wires—Periodically (weekly suggested) inspect all the Cables on the machine for kinks or broken wires. Never drive nails or wedges into the Cable.



**Keep Your Hands Off Moving Cables**—Keep your hands clear of Cables feeding in on Sheaves or Drums. To guide a Cable being wound on a Drum, use a bar to shift the Cable.

## HAULING EQUIPMENT AND YOU

A test run, with the handling and spotting of trucks under the supervision of some responsible person, frequently can result in a procedure that will pay off in extra yardage. If efficient and uniform spotting is responsible for any appreciable increase in production, the needed control should be set up to maintain the gain.


AVOID A CONVENTION OF TRUCKS AT THE EXCAVATION

**A "Convention" of Trucks at the Shovel Indicates Poor Planning**—Try to keep trucks rolling with even distribution. Avoid bunching them at the excavator as this means time lost by both the excavator and the trucks. Get the first truck or two out especially fast if they begin to jam up.

**"Two-Timing" the Excavator adds to Yardage**—Save loading time with two-truck spotting. Have trucks spotted in as close to the digging as is safe and always at the same distance from center of rotation, lined up with the arc of swing.

**Proper Spotting Helps with Sticky Materials**—In shovel operation position truck so Dipper will be extended beyond Boom Point but with 2 or 3 feet of Stick remaining. This permits the operator to jar loose any material that might stick to the Dipper by shaking it.

**"Hitting-the-Spot" adds to Output** — For back-in spotting, use a log or tie as a bumper to (a) get the trucks in close, (b) provide uniform position and (c) to permit faster truck spotting.

**Don't Swing the Load Over the Truck Cab while loading.**

DON'T OVERLOAD THE TRUCKS

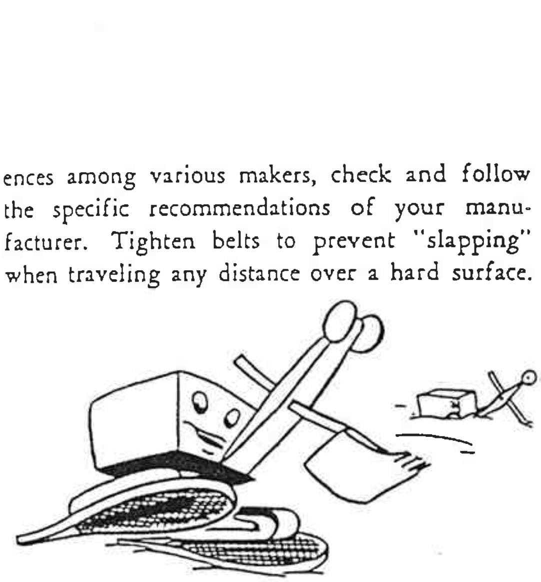
**Don't Overload the Trucks**—(a) Don't drop the load into the truck and bang the body to pieces—(b) load hauling units evenly to avoid overloading rear axles—(c) don't load hauling units to the point where earth and rocks run over the sides.

**Don't Get Stuck with Sticky Materials**—In sticky material, try to save any dry sand or loose dirt to spread in the bottom of the truck to act as a cushion and to help ease of dumping.

## USE OF CRAWLER MOUNTINGS

**Use Proper Drive-Chain Tension**— A Chain that is too tight will wear rapidly. However, don't loosen it too much or you'll have a loose slapping chain, resulting in destructive jerks when propelling is started or stopped. Drive Chains should be adjusted before taking up slack in Tread Belt.

**Use Proper Tread Belt Tension**—Tread Belts are your working base. In general, use a tight belt on firm footing—a loose one in mud or loose dirt; however, because of design differences among various makers, check and follow the specific recommendations of your manufacturer. Tighten belts to prevent "slapping" when traveling any distance over a hard surface.



**Don't Hesitate to Use Mats** — Heavy timber mats can be used to support the machine for work on soft ground. The mats should be kept level and as clean as possible.

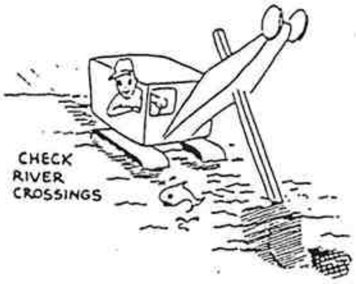
**Position the Crawler Correctly**—(a) For Shovels, work with the Crawler Drive Chains toward the rear, away from the excavation as your direction of travel will be moving up *toward* the excavation.

(b) For Draglines and Hoes, work with the Crawler Drive Chains at the front, toward the excavation as you will be moving *away* from the job as the work progresses.

(c) These positions keep the Crawlers in the best positions for "moving-up" on the job; and provide the most effective braking resistance to digging thrusts or pulls; also these positions keep a tight tread belt on the ground and a loose belt on the top where it belongs while digging or moving.

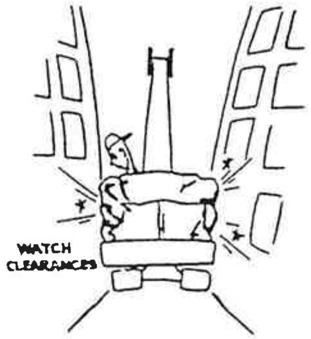
**Uphill Steering**—It is a wise extra precaution when moving up a steep hill to block treads against downhill movement before shifting Steering Clutches.

**Keep Suspended Load at Rear When Moving** — If you must move with a load in soft going, remember the Crawler will travel better if you move with the load behind. When traveling with a suspended load, snub it to the machine to prevent swaying.



**Check Depth of Rivers When Fording**—When fording rivers which may have hidden boulders or dangerous holes, proceed as follows: If water is muddy, use Dipper to feel your way across, stopping the machine while you swing the Dipper from side to side to detect large stones or boulders. Lower Dipper to measure depth of water and to avoid dangerous holes.

**Be Sure Bridges are Safe**— When traveling across country bridges, first check to make sure they will carry a load equal to the machine's weight.



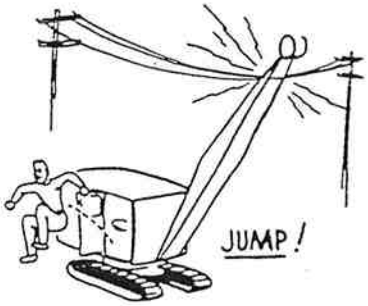
**Watch Clearances When Traveling**—Avoid running into overhead or side obstructions. When moving in tight quarters, post a lookout to help guard against collisions or bumping into buildings.

## WORKING AROUND HIGH LINES

**Always Keep the Boom at least 6 feet from all Overhead Wires.**

**What To Do If Boom Hits Overhead Wires:**
(a) Your best bet is to stay on the machine until the Boom is cleared or the current is cut off.

(b) Don't let anyone on the ground touch the machine.



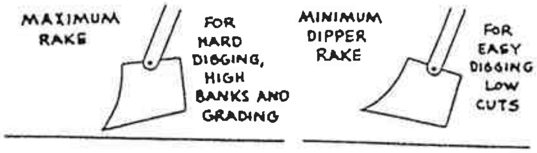
(c) If you *have* to leave the machine, *jump*, do not step off.

## SHOVEL OPERATION

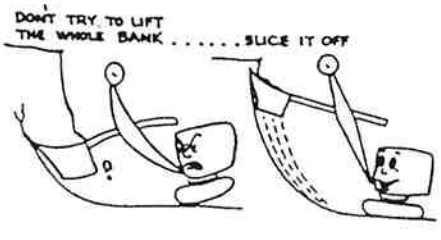
**First Look the Job Over**—Length and depth of cut should be judged to produce a full dipper at every pass. Full loads every pass produce more pay dirt than a faster cycle with a partly filled Dipper. Full loads should be the *first* objective; then, increased speed for faster cycles.

**Keep the Dipper Teeth Sharp**—Get heaping loads on every pass.

**Powder is Cheaper than Equipment** — If blasting is necessary, banks should be *well* blasted. Blast holes should be deep to break out well under grade. Scratching out half-filled buckets cuts production, boosts maintenance.



**Set Dipper at Proper "Raking" Angle**—Adjust Dipper for proper "rake" or digging angle relative to Dipper Stick for type of material handled. Minimum "rake" is for easy digging and low cuts—maximum "rake" for harder digging and for higher banks and grading.

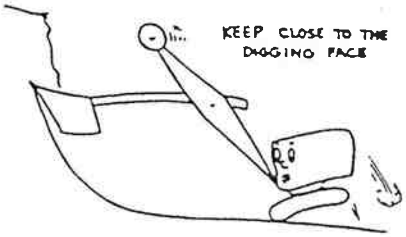

DON'T TRY TO LIFT
THE WHOLE BANK ...... SLICE IT OFF

**Don't Try to Lift the Whole Bank at One Time**—Slice it off instead! If you crowd the Dipper in too fast and hard at the start of the cut, you'll fill the Dipper very quickly and have to pull the loaded Dipper up through the column of dirt above the Dipper . . . It's just like trying to lift the whole bank at one time . . . Instead, dig the bank by taking a thin slice at a time so as to end up with a full Dipper at the top of the cut . . . This will permit the Dipper to hoist through the bank more easily and quickly, with less wear and tear on the machine.

**Dig the Top Half of High Bank First**—This will avoid lowering the Dipper to the bottom each cycle, will also prevent overburden from rolling into the pit. Then follow by next digging the bottom half. This method gives the shortest cycle time, hence the best production.

**Remove Cut in Layers**—Take the cut out in a series of layers across the entire face. Start digging next to spotted truck and work in toward center of cut.

**Use the Proper Boom Angle**— Shovel Booms are usually worked at 45° to 50° for general digging. Lowering the Boom permits a longer cut in a shallow bank at better hoist rope angle—also gives you extra reach. Raising the Boom increases dumping heights and improves stability for heavy digging.



**Keep Close to the Digging Face** — Many short moves will permit keeping close enough to the bank to maintain the most efficient position by digging as nearly under the Boom Point as possible.

**Don't Reach Too Far**—Move up while you still have several feet of Dipper Stick left. Do not work out beyond the Boom Point more than necessary. This will save time and increase digging efficiency because when working with too much reach time is lost crowding and retracting.

DON'T LET DIPPER HIT THE MACHINE

**Don't Let Dipper Hit the Machine** — When returning to digging position, don't let the Dipper strike the lower side of the Boom or the Crawler Tread Belt, unless you want to see maintenance cost go up rapidly. A little care will save a lot of cost.

DON'T USE THE SHOVEL TO SWEEP

**Don't Sweep With the Dipper Stick**—Avoid sweeping the Dipper back and forth like a broom in order to level off ahead of machine. This causes side strains and wear on the Shovel Boom, Dipper Stick and Dipper. Use the normal digging cycle for this kind of work.

NEVER SWING OVER CAB OF TRUCK

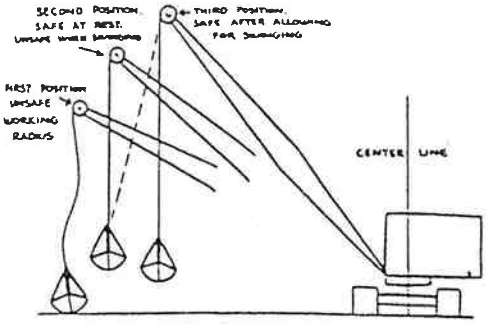
**Never Swing Over Cab of Truck** — Spot trucks so that they can be loaded from the rear—never swing load over cab. In loading dangerous materials, have the driver get out of the truck and stay on the safe side.

## CRANE OPERATION

**Watch Your Footing**—Try to locate machine on as solid and level ground as possible. Fill in if necessary to build good footing—or use mats. Your ability to lift safely is based largely on a proper "foundation."

**Plan Your Movements**—Organize for minimum travel time. All needed lifts in one area should be completed before moving to another location. The Crane should be located and the job planned to handle lifts to the farthest points first. This provides greatest use of Boom and load clearances and avoids blocking yourself on later lifts.

**Be Sure You Know How Much You're Lifting**—In figuring the total weight of the lift, be sure to include the block, hook, and any sling or other handling device between the hook and the load. When making near capacity lifts, calculate the entire load carefully and check it against the rated lifting capacity of the Crane. It takes less time to check clearances and loads ahead of time than to try to lift and not make it and then have to boom up, to reposition the crane and load for another try . . . Besides, it's safer.


SECOND POSITION SAFE AT REST. UNSAFE WHEN SWINGING
THIRD POSITION SAFE AFTER ALLOWING FOR SWINGING
FIRST POSITION UNSAFE WORKING RADIUS
CENTER LINE

METHOD OF DETERMINING SAFE WORKING RADIUS

**Before Starting to Work, Check the Working Radius** — The following "rule of thumb" procedure may be followed: To determine the approximate working radius of loaded buckets or hook block loads, always check these against the rated lifting capacities of the machines for the working radius as published by the manufacturer. These will usually be found posted in the cab near the operator. Usually, when such published rated lifting capacities are exceeded, the manufacturer will not underwrite the machine warranty.

(a) Make certain that the mounting is resting on firm, level ground.

(b) With Boom extended directly over the side of Crawler (or rubber-tire units) raise the load or Bucket about three feet from ground.

(c) Hold the load or Bucket in the suspended position and, at the same time, slowly lower the Boom until the machine just starts to tip. Then raise Boom slightly until machine regains solid footing and stable position.

(d) Swing Turntable at the same swing speed you will use when operating. Hold foot on Foot Brake, ready to drop the load or Bucket in case the machine starts to tip. As the load swings away from the machine due to centrifugal force, it may cause machine to tip although there was no indication that it would tip when not swinging.

(e) If possible, swing the load or Bucket clear around to complete the circle. Then swing in opposite direction.

(f) After swing test is completed, raise the Boom about two feet (or whatever seems reasonable) to give added stability and factor of safety.—Check again to be sure the load being lifted does not exceed the rated lifting capacity of the machine.

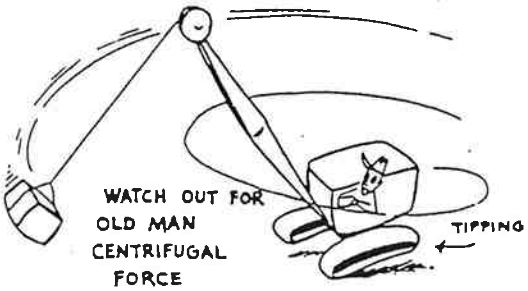
USE SUFFICIENT PARTS OF LINE...
TO DO THE JOB RIGHT

**Use Sufficient Parts of Line for Heavy Crane Lifts** — To obtain maximum lifting capacities, the Hook Block must be reeved with sufficient parts of line. See the Capacity Data on your crane for necessary parts of line for various loads . . . In general, the fewer the parts of line used, the faster the hoisting speed and the less the capacity; increasing the parts of line reeved, increases the load capacity but reduces hoisting speed and therefore improves the accuracy of spotting loads.

**Use a Level Swing**—Level footing eliminates swinging "up or down hill" and requires less power, is faster and safer.

**Use the Shortest Boom That Will Do the Job** — Crane Boom length should be kept as short as possible for maximum lifting capacity and greater safety. Shorter Booms will also increase Swing Clutch life since less power will be needed to swing the machine. Longer Booms require additional care in accelerating and decelerating the swing motion, and thus slow down the working cycle and tend to reduce production.

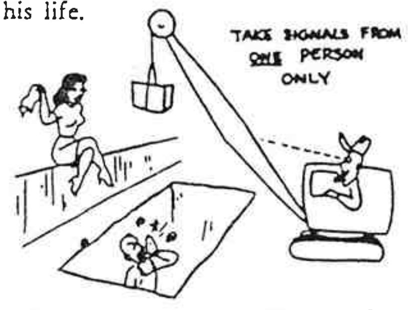
**What Happens When You Use a Jib**—Adding a Jib or Tip Extension to the Boom increases the working ranges both horizontally and vertically but also *limits* the lifting capacity to the maximum capacity of the Jib. When using a Jib, particularly on a long Boom, greater care is required in accelerating and decelerating the swing in order to avoid "whipping" the Jib sideways and damaging the Boom proper.


WATCH OUT FOR OLD MAN CENTRIFUGAL FORCE
TIPPING

**When Swinging, Watch Out for Old Man "Centrifugal Force"** — The operator should swing the crane slowly enough to avoid any outward throw of load due to centrifugal force and any overswinging of the load when the machine is stopped. Crane work is similar to moving a long pendulum which can be controlled only in slow motion. Fast swinging of crane loads will lose more time than it gains through loss of control and is very dangerous. A tagline device, similar to that used for Clamshell Buckets, can be attached to loads to control outward swing.

1. Avoid rapid acceleration or deceleration when swinging loads.
2. Be sure to keep the load directly and vertically under the boom point at all times. Crane booms are designed primarily to handle vertical loads, not side lifts.

**Watch Your "Hitcher"**—Check your "hitcher-on" to be sure all loads are secure before lifting. If he is careless either in attaching loads or keeping out from under loads, he is endangering his own and other lives as well as risking damage to material and equipment . . . Don't lift the load until your "hitcher-on" is in the clear and completely visible to you. Don't take chances with his life.


TAKE SIGNALS FROM ONE PERSON ONLY

**Take Signals From One Man Only** — And be sure you both know the signals. If standard hand signals are not used, be sure you and the signal man have gotten together and understand whatever signals are agreed on.

AVOID WORKING WITH BOOM TOO HIGH

**Watch Out for High Booms** — Don't work with the Boom too close to the vertical, as a sudden release of the load may throw the Boom back over the Cab. Attempting to travel the machine with the Boom at a high angle, especially on uneven terrain, may result in the Boom being thrown back over the Cab.

**Control the Load at All Times**—Use hand-lines to guide the load . . . If necessary, snub heavy loads to prevent excess outward motion when swinging or traveling.

## DRAGLINE OPERATION

**Select the Right Size Bucket** — The Bucket should not be too large for the machine. The efficient use of the Dragline is dependent on an efficient cycle involving digging, hoisting, swinging, and dumping. This means (a) the power of the machine to accomplish these, (b) as well as the weight of Bucket plus the weight of a bucket load of the material, (c) the use of proper laggings, (d) and the length of Boom must be taken into account as governing factors for proper bucket size, rather than just the ability of the machine to lift a certain total load.

**Sharp Teeth Mean Sharp Results** — The teeth of the Bucket start the digging and, therefore, get the most punishment. They must be sharp at the cutting edge and tight on their bases to secure the best results. Never operate your Bucket without all points in place.

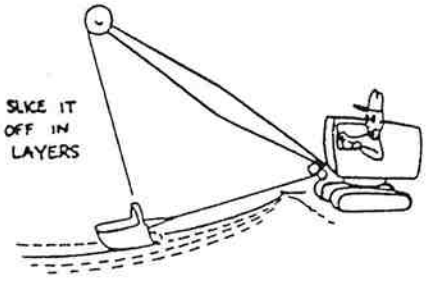
**Inspect the Drag Chains**—It is a good idea to inspect Drag Chains periodically, giving particular attention to end links, as these are subject to most wear. Often you can extend chain life by reversing it, end-for-end or top-for-bottom. If both ends are worn, cut chain in middle and reverse the sections, using repair links for rejoining them.

**Adjust Chain Hitch for Proper Results —** Chain Hitch on the Bucket should be shifted if it fails to dig the material properly.

**Adjust Dump Cable for Proper Results —** If you use the proper length of Dump-Cable, the Bucket can be picked up at a considerable distance ahead of the machine without spilling dirt. When the Dump-Cable is too long, it is necessary to pull the loaded Bucket close up to the Fairlead to keep it level. Also, too long a Dump-Cable causes the Bucket to dump before it gets out under the Boom Point for maximum reach.

**Keep the Boom as High as the Job Will Allow—** Work with the Boom at the highest angle that will allow the reach and accuracy needed for the job. With a low Boom (30° to 40°) you have longer reach and better control of the throw of the Bucket, along with more accurate grading and dumping. However, a high Boom (40° to 50°) increases stability, decreases swing loads and swing power requirements.

**Avoid Unnecessary Casting—** The machine should be kept in an efficient position with relation to the work to eliminate digging beyond the point of the Boom as much as possible, as well as to reduce unnecessary casting and hoisting.

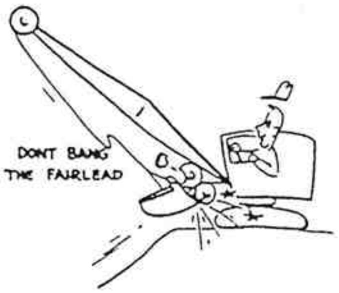


**Slice It Off in Layers —** Material should be taken off in layers. In ditch excavation, the sides or slopes should be taken out ahead of the center so that the ditch may be kept from narrowing . . . This will also prevent having to use the Swing Clutches to hold the Bucket against the sides.

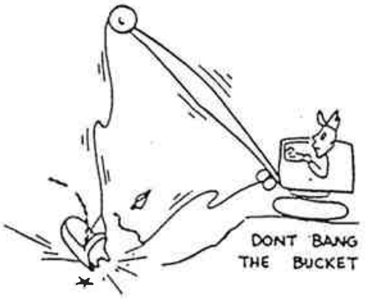
**Use a Short Haul—** Many operators get into the habit of pulling the Bucket a greater distance than is necessary to fill it, thus wearing out the Bucket and Drag Cable unnecessarily. Use as short a haul as you can get by with. After the Bucket is full no more material can be loaded no matter how far you drag it.

**Save Your Drag Cable—** Move back and dig off top edges that might wear or cut your Drag Rope. Avoid piling dirt on your "door step". Hoist the Bucket just as soon as it is filled. It won't get any fuller. Piling dirt under the boom foot wastes time and power and makes a "wearing" trap for the Drag Rope.

**Don't "Hug" the Boom—** During the hoisting cycle, keep the Bucket as far away from the Boom as possible, without spilling the load. This will produce the best results and will reduce the wear and tear on Cables and Clutches; also will minimize possible damage to the Boom and Bucket.



**Don't Bang the Fairlead—** Avoid pulling the drag-bail socket into the Fairlead . . . Keep all dirt and mud cleaned off Fairlead. You'll have less wear on Cable and Fairlead.



**Don't Bang the Bucket**— When the Boom is in motion, the Bucket is lagging behind so do not drop the Bucket to stop the swing of the machine . . . Don't bang the Bucket against banks or trucks to knock out sticky mud . . . Do not get into the habit of dropping the Bucket in a heap, because the Cable and Chains may become tangled and considerable time will be lost on each bucket load.

## CLAMSHELL OPERATION

**Select the Right Size Bucket** — The Bucket should not be too large for the machine. The efficient use of the Clamshell depends on an efficient cycle of digging, hoisting, swinging, and dumping. This means (a) the power of the machine to accomplish these, (b) as well as the weight of the Bucket plus the weight of a bucket load of the material, (c) the use of proper laggings, (d) and the length of the Boom, must be taken into account as governing factors for the proper bucket size, rather than just the ability of the machine to lift a certain total load.

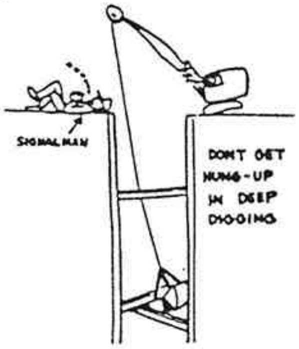
**Pick Up the Bucket as Soon as It is Filled**—Start to swing as the Bucket is being raised to save time on the working cycle and increase output.

**Keep a Tight Closing Line While Hoisting**—Never release the closing line while the Bucket is being raised or Bucket will open too soon.

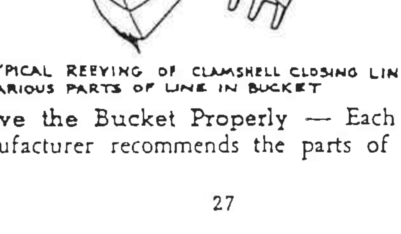
**Avoid Closing Bucket While Lowering It**—When returning to digging position, with open Bucket, never tighten up on the closing line or Bucket will close in mid-air.

**Match Lengths of Closing and Holding Cables** — This is particularly necessary in deep digging which requires spooling more than one wrap of Cable on the Drum. With properly matched cable lengths, both closing and holding cables will start the second wrap at the same time to provide a smooth operation. Otherwise the Bucket will jerk and (a) open partially during the hoist cycle, or (b) drop partially during the dumping or lowering cycle, depending on which Cable is too short for proper matching of cable length.

**Attach Tagline for Desired Action**—Attach the Tagline to hold the Bucket in line with the Boom, or cross-wise to the Boom, whichever will give best control of Bucket placing and dumping for the job condition.


SIGNAL MAN
DONT GET HUNG-UP IN DEEP DIGGING

**Don't Get Hung Up on Deep Digging**—When raising or lowering the Bucket into deep, sheathed trenches, where you can't see the Bucket, use a signal man to advise you of the bucket's position so as to avoid hanging it up on cross bracing or tearing out sheathing. Lowering the Bucket closed and opening it on signal some times is advisable when working blind. This gives greater clearances when lowering.

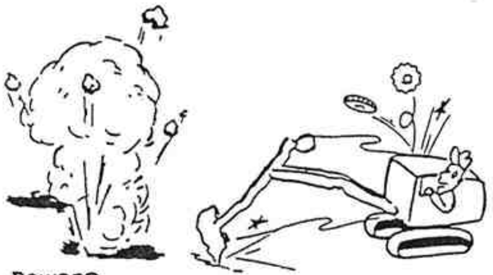

HOLDING LINE
DEAD END HERE FOR 2-4 OR 6 PART LINE
4-PART CLOSING LINE
DEAD END HERE FOR 3 OR 5 PART LINE

TYPICAL REEVING OF CLAMSHELL CLOSING LINE FOR VARIOUS PARTS OF LINE IN BUCKET

**Reeve the Bucket Properly** — Each Bucket manufacturer recommends the parts of line to be used in reeving the Bucket for various types of materials and digging. Follow these recommendations for best results . . . In general, loose flowing materials require fewer parts of reeving and thus will give faster Bucket closing . . . For harder materials or digging, increase the parts of line reeved in the Bucket (and also add reccommended Bucket Counterweight) to get better Bucket penetration and digging.

**Don't Bang the Bucket**—Don't bang Bucket against the bank, the hauling unit or bin to release sticky material. Instead close Bucket and release closing line quickly to "shake" material loose.

## HOE OPERATION



POWDER ......IS CHEAPER THAN REPAIRS

**Powder's Cheaper than Repairs**—While a hoe will dig fairly hard materials, blasting often will be less expensive than bulling through harpan and rock strata with the Hoe Dipper.

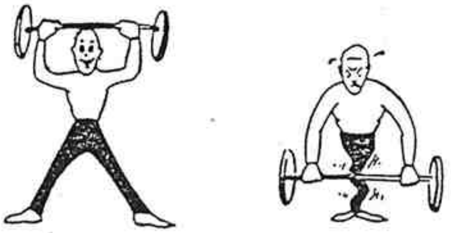
**Don't Use The Hoe as a Pick** —When digging hard materials, avoid using the Hoe as a pick to loosen hard materials unless repair costs and down-time mean nothing to you.

**Use the Best Position for Best Digging**—Start loading bucket with the stick in a nearly vertically position. The Bucket digs best at this point. The Bucket tends to ride out of material with the bucket out past the vertical position.

**Don't Swing Into Ditch Walls** — (1) Clear bank or ditch walls before attempting to swing; (2) on returning to digging position, stop the swing before dropping the attachment in the ditch or excavation.

**How to Dump Into Trucks**—When dumping into trucks, always raise the Boom simultaneously while extending the Dipper Arm. If dumping into trucks is attempted without raising the Boom, the Boom will lower as Dipper Arm is extended and Dipper may hit the truck and cause damage to truck and Boom.

## RUBBER-TIRE MACHINES



YOU CAN LIFT MORE THIS WAY..... THAN THIS

**Use Outriggers for Maximum Lifts** — The maximum capacities of rubber-tire machines are obtained when Outriggers, fore and aft, are extended and blocked properly.

**Make Heavy Lifts Over Rear End**—If possible, for heavy lifts, Crane should be positioned to lift over rear end of mounting as this usually is position of maximum lifting capacity. If load is swung over the side after initial lift is made over rear, do it with caution if no outriggers are set.

**Keep Carrier Transmission in Neutral When Operating** —When operating, be sure the Carrier engine transmission is placed in neutral so that any rocking or back-and-forth motion of the Carrier will not be transmitted to engaged gears with the possible danger of damage to them.

**Lock the Air Brakes While Operating**—On all rubber-tire Cranes, lock the Air Brake in "on" position to hold the machine during operation.

**Don't Rely on Air Brakes When Parking**—The Air Brakes should be set when the machine is parked but, because of possibility of leakage and loss of pressure over extended periods, always use the Parking Brake also . . . In addition, block the wheels of Carrier if parking on a grade.

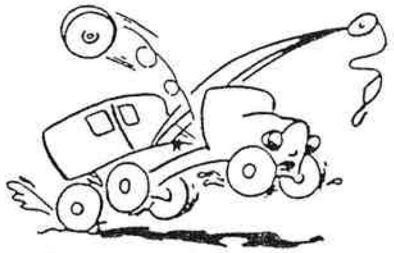
**Watch Air Brake Pressure** — Never depend on the Air Brakes to hold the machine without checking Air Brake Pressure to be sure it is being maintained at 60 lbs. or more. Use regular Parking Brake when parking machine for long periods.

DON'T OVERLOAD FRONT AXLE WHEN TRAVELING WITH LOAD

**Don't Overload Front Axle When Traveling With Load**—If loads are suspended over front end of rubber-tire machines when traveling, refer to Capacity Data for your machine to determine safe load that may be carried in this manner, as heavier loads may overload and damage front axle.

**Lock the Turntable Against Swing Before Traveling**—Before moving a rubber-tire Crane over the highway for any long distances, always be sure the Turntable is locked against side sway by suitable chains or locking device.

**Always "Double Clutch"** when shifting Gears on Rubber-Tire machines.



DON'T FLYWHEEL THE CARRIER IN MUD + MUCK

**Don't "Flywheel" the Carrier**—Never "rev" up the Carrier engine, then let the Clutch in quickly in an attempt to jerk or rock the unit out of a bad spot. Such "flywheeling" will eventually damage the running gear . . . Instead, use the lowest speed in the auxiliary transmission. If machine is still stuck, obtain the help of another truck or a tractor.

**Keep the Carrier Battery Charged**—When Carrier Engine is permitted to idle for long periods during operation of machine, maintain an engine idle speed sufficient to show a positive reading on the Ammeter to enable generator to charge battery at a satisfactory rate.

**For Best Tire Life, Take Care of Them**—To prevent excessive wear on tires and overheating of the drive units, it is imperative that the tires be carefully matched as to size and degree of wear . . . Check daily and maintain proper tire inflation in all tires for best operation. This is particularly essential when handling loads on tires alone without Outriggers.

REMEMBER, THE OPERATOR
IS THE "BRAIN"

# HAND SIGNALS FOR SHOVEL CRANE OPERATION

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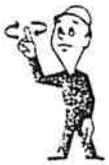
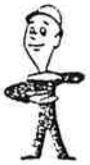
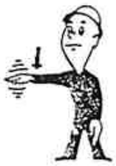
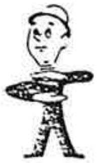
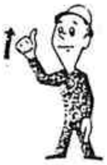
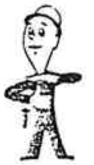
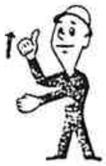
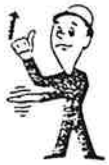
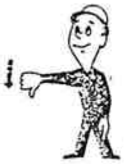
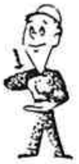
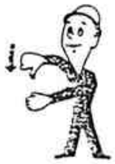
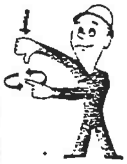
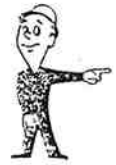
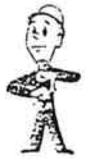
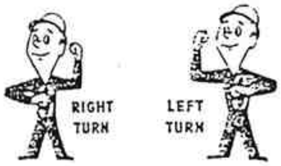
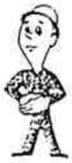
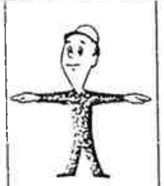
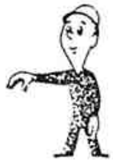
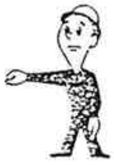
|  RAISE THE LOAD |  RAISE THE LOAD SLOWLY |  LOWER THE LOAD |  LOWER THE LOAD SLOWLY |
|  RAISE THE BOOM |  RAISE THE BOOM SLOWLY |  RAISE THE BOOM AND HOLD THE LOAD |  RAISE THE BOOM AND LOWER THE LOAD |
|  LOWER THE BOOM |  LOWER THE BOOM SLOWLY |  LOWER THE BOOM AND HOLD THE LOAD |  LOWER THE BOOM AND RAISE THE LOAD |
|  SWING THE LOAD IN DIRECTION FINGER POINTS |  TRAVEL BOTH CRAWLER BELTS IN DIRECTION INDICATED BY REVOLVING FISTS |  LOCK THE CRAWLER BELT ON SIDE INDICATED BY RAISED FIST — TRAVEL OPPOSITE CRAWLER BELT IN DIRECTION INDICATED BY REVOLVING FIST | |
|  DOG EVERYTHING |  STOP |  OPEN CLAMSHELL BUCKET |  CLOSE CLAMSHELL BUCKET |

AS ADOPTED BY THE POWER CRANE AND SHOVEL ASSOCIATION MARCH 15, 1956

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